KIRNICHANSKIY, I.V.

Rational treatment of fractures of the femoral neck in elderly and senile persons. Trudy Kish.gos.med.inst. 12:81-86 '60. (MIRA 16:4)

1. Kafedra gospital'noy khirurgii Kishinevskogo gosudarstvennogo meditsinskogo instituta.

(GERIATRICS) (FEMUR--FRACTURE)

KIRNICHANSKIY, I.V.

Immediate and late results of surgical treatment in obliterative endarteritis and senile gangrene. Trudy Kish. gos.med.inst. 12:97-104 '60. (MIRA 16:4)

1. Kafedra gospital'noy khirurgii Kishinevskogo gosudarstvennogo meditsinskogo instituta.
(GERIATRICS) (ARTERIES--DISEASES) (GANGRENE)

KIRNING, S. [Kyrning, S.]

Chemical method for determining vitamin A in feeds. Vitaminy no.5:61-73 '59. (MIRA 14:11)
(VITAMINS--A) (FEEDS--ANALYSIS)

KIRNIS, KH. S.

62/49T80

[redacted]/Metals Jul 49
Alloys
Solubility

"Accuracy in Determining the Limits of Solubility in Binary Metallic Systems," I. L. Rogel'berg, S. Kh. Kirnis, 4 pp

"Zavod Lab" No 7

Attempts to throw light on the problem of average possible and maximum accuracy in determining limits of solubility under given conditions. Analyzes accuracy possible in measuring properties and structure, temperature (and its regulation), chemical analysis, and the relationship

[redacted] 62/49T80

[redacted]/Metals (Contd) Jul 49

between the relative errors of these measurements, with practical example. Concludes that accuracy in measuring temperature will usually determine maximum accuracy in constructing the limits of solubility since other relative errors are several times larger than temperature error.

[redacted] 62/49T80

KIRNITSKIY, B., red.; MAGER, M., red.

[Concise manual for the agronomist and field crew foreman] Keleuza agronomului shi a brigadirului. Kishinev, Editura do Partid a Komitetului Chentral al PK al Moldovei, 1964. 469 p. [In Moldavian]
(MIRA 18:9)

KIRNITSKIY, B.T.

"The Peculiarities of the Utilization of a Perennial Grass Layer Under the Conditions Prevailing in the Moldavskaya SSR." Cand Agr Sci, Moscow Agricultural Acad imeni Timiryazev, Moscow, 1953. (RZhBiol, No 2, Sep 54)

Survey of Sceintific and Technical Dissertations Defended at USSR Higher Educational Institutions (10)

SO: Sum. No. 481, 5 May 55

KIRNITSKIY, B.T., kand. sel'skokhozyaystvennykh nauk.

Alfalfa in the central Urals. Zemledelie 6 no.6:80-82 Je '58.
(Ural Mountain region) (MIRA 11:6)

KIRNOS, D. P.

Kirnos, D. P. "Some Particular Cases of the Forced Movement of the Pendulum (on the Seismograph)." Trudy Seismicheskogo Instituta Akad. Nauk S.S.S.R., Leningrad-Moscow, No. 79, 1938, pp. 5-13.

KIRNOS, D. P.

Kirnos, D. P. "Fundamentals of the Theory and the Calculation of Oscillographs." Trudy Seismologicheskogo Instituta Akad. Nauk S.S.S.R., Leningrad-Moscow, No. 81, 1938, pp. 1-91.

KIRNOS, D. P.

USSR/Geophysics Jul/Aug 48
Seismometry
Seismograph

"Modern Seismometric Apparatus," D. P. Kirnos and M. V. Vashnyakov, Acad Sci USSR, Geophys Inst, 8½ pp

"Iz Ak Nauk SSSR, Ser Geog i Geofiz" Vol XII, No 4

Describes apparatus recently released by Seismological Inst, Acad Sci USSR: new type of seismograph with galvanometer type register for registering displacement of crust during earthquakes, and electromagnetic type extensometer for determining dynamic deformation of soil. Submitted 3 Mar 1948

1/49761

KIRNOS, P. and KHARIN, D. A.

"Main Instruments Used at the Seismic Stations of USSR," one of the reports given at the 10th General Assembly of the International Union of Geodesy and Geophysics, Rome, 1954.

Evaluation, B-86198 and 86204, 30 Jun 55

KIRNOS, D.P.

USSR/Geophysics - Earthquakes FD 350

Card 1/1

Author : Andreyev, S. S.

Title : The method of equal surfaces in the interpretation of local earthquakes

Periodical : Izv. AN SSSR, Ser. geofiz. 2, 153-159, Mar/Apr 1954

Abstract : Expounds two methods for interpretation of the record of local earthquakes that are based on the application of time fields. The methods are illustrated by examples of treating the weak earthquakes recorded in southwestern Turkmenia. Two references: Ye. F. Savarenskiy and D. P. Kirnos, Elementy seysmologii i seysmometrii, Moscow/Leningrad, State Publishing House of Technical Theoretical Literature, 1949; Yu. V. Riznichenko, "Geometric seismics of laminar media," Trudy In-ta Teoretich. Geofiziki (Works of the Institute of Theoretical Geophysics), Vol II, No 1, 1946.

Institution : Geophysics Institute, Acad Sci USSR

Submitted : January 6, 1954

KIRNOS, D.P.

SAVARENSKIY, Yevgeniy Fedorovich; KIRNOS, Dmitriy Petrovich; ALEKSEYEV, D.M., redaktor; MURASHOVA, N.Ya., tekhnicheskiy redaktor.

[Elements of seismology and seismometry] Elementy seismologii i seismometrii. Izd.2-e, perer. Moskva, Gos.izd-vo tekhniko-teoret.lit-ry, 1955. 543 p. (MLRA 8:9)
(Seismology)

KIRNOS, D.P.; SAVARENSKIY, Ye.F., professor, doktor fiziko-matematicheskikh nauk, redaktor; SHEBALIN, N.V., redaktor; STRELNITSKIY, I.A., tekhnicheskiy redaktor.

Some problems of instrumental seismology. Trudy Geofiz.inst. no.27: 3-168 '55.
(Seismometers)

KIRNOS, D. A.

KIRNOS, D. A. and CHARIN, D. A. (Moscow)

"Ein Seismograph fur die Untersuchung von Sprenz und Nahbebenwirkungen,"

paper presented 1st Seismological Conference of the Geophysics Inst. Czecholovakian Acad. Sci., Liblice, 22 March 1957.

Bergakademi (Berlin) No. 4, 1957.

KIRNOS, D.P.

AUTHOR: Savarenskiy, Ye. F. 49-4-23/23

TITLE: First seismological conference of the Czechoslovak Ac.Sc. (O pervoy seysmologicheskoy konferentsii Chekhoslovatskoy Akademii Nauk).

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, 1957, No.4, pp.558-559 (USSR)

ABSTRACT: This conference was held between March 18 and 22, 1957 in Liblice, the aim of which was to acquaint seismologists of various countries with results of studies of seismicity, determination of the intensity of earthquakes, study of the structure of the Earth's crust, investigation of the propagation of seismic waves and design of apparatus. In addition to Czech seismologists, there were three seismologists from Hungary, three from Eastern Germany, two from Poland, one from Roumania and five from the Soviet Union. The conference was also attended by the General Secretary of the International Association of Seismology and Physics of Mineral Resources, Prof. Rothe of France. A total of thirty papers were read. Soviet delegates read the following papers:

1. Yu. V. Riznichenko "Study of the structure of the Earth's crust in the U.S.S. by the method of deep seismic sounding";

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First seismological conference of the Czechoslovak Ac.Sc. 49-4-23/23

2. P. S. Veytsman "On the results of work of deep seismic sounding of the Earth's crust in one of the mountainous regions of Central Asia;
3. N. V. Shebalin "Evaluation of the depth of the astenosphere in the region of the Vranch (Carpathian) mountains from the point of view of the relation between the intensity and the "ballicity" of earthquakes";
4. S. L. Solov'yev "On corrections to the values of earthquake intensities";
5. D. P. Kirnos and D. A. Kharin "Seismography for studying the seismic effect of explosions, vibrations of engineering structures and nearby earthquakes";
6. Ye. S. Borisevich "Magneto-electric oscillographs for scientific geophysical investigations";
7. Yu. V. Riznichenko "Application of ultrasound for seismological problems".

At the end of tne report a brief table is given of the Czechoslovak stations participating in work in conjunction with the International Geophysical Year in which the type of instruments and the subject of investigations are also mentioned.

Card 2/2

AVAILABLE: Library of Congress.

KIRNOS, D.P.

Development of Russian seismic instrumental observations.
Biul. Sov. po seism. no.6:9-15 '57. (MIRA 11:3)

1. Institut fiziki Zemli Akademii nauk SSSR, Moskva.
(Seismology)

SOV/49 -58-12-2/17

AUTHORS: Kirnos, D. P. and Kondorskaya, N. V.

TITLE: Amplitude of Ground Movement at the Onset of a Seismic Wave (O vychislenii istinnogo znacheniya pervoy amplitudy dvizheniya pochvy pri vstuplenii seysmicheskoy volny)

PERIODICAL: Izvestiya akademii nauk SSSR, Seriya geofizicheskaya, 1958, Nr 12, pp 1443-1450 (USSR)

ABSTRACT: As a preliminary condition of the calculation, a determination of the magnification ($\bar{V}$) in the registration by a seismogram should be made. Next, a mathematical formula is found, where the displacement of soil, X , is related to time t . Thus a differential equation (1) is formed. From the graph $x(t)$ and $\bar{y}(t) = y(t)/\bar{V}$ the distortion of the seismograph can be shown in the form $X_k/\bar{X}_k = \bar{U}_k$, where $\bar{X}_k$ is the V-times reduced amplitude and X_k is the amplitude of ground displacement. This formula contains the form Eq.(2) for the first amplitude. Then the true value of the amplitude of displacement is equal to

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Eq.(3). If the apparatus gives no distortion, then $\bar{U}_k = \bar{U}_1 = 1$ and $X_1 = y_1/\bar{V}$ (3a). The sinusoidal character of the seismic wave having the characteristics (4) is considered. Then the Eq.(5) can be applied for the apparatus of linear registration (y - coordinate, ε_1 - coefficient of pendulum damping, n_1 - pendulum frequency, V_o - normal magnification). The coordinate y can be found from Eq.(6) (Ref.8), where U_1 - frequency characteristic, γ_1 - pendulum phase, F(t) - time function. This equation becomes Eq.(7) for the apparatus with a galvanometric registration. The indicator magnification $\bar{V}$ can be found from Eq.(8) where A_2 is the distance from the mirror of the galvanometer to the photocell. When $\sigma^2 \ll 1$, Eq.(7) can be written as Eq.(9). For the apparatus of the common type, the formula (10) can be applied, which is based on the curve (Fig.1). The first frequency characteristics can be found from Eq.(11). This characteristic for the first 3 maxima is shown in the

Amplitude of Ground
Movement at the Onset of a Seismic Wave

form of graphs in Fig.2. The registration $y(t)$ by the apparatus can be shown as Eq.(12), from which the value of the asymptote can be found for the minimum $t_1 \approx 1.6$ sec for the large T_ω (Fig.3). The relationship of $\bar{U}_1 = f(t_1)$ and $\bar{U}_1 = f(t_{III} - t_{II})$ is shown in Fig.4. The analysis of about 100 earthquakes for various epicentral distances showed that the above theoretical considerations agree with the practical results (Fig.7). Therefore, the following conclusions can be made: the time of growth of the first maximum for near and deep earthquakes is less than 1.6 sec for both the longitudinal and transverse waves (Fig.5). In the case of greater distances ($\Delta^\circ > 20^\circ$) the time $t_1 > 1.6$ sec but it can still be $<$ 1.6 sec in the case of the wave P . Fig.6 shows an

On the Calculation of the True Value of the First Amplitude of Soil Movement under the Action of Seismic Waves

example of the registration of the first longitudinal and transverse waves for various stations. The relationship between the intensity of earthquakes and the time t_I could not be established. Fig.8 shows the relation $\overline{U}_t = f(t_I)$ of Galitsyn's galvanometric registration. The relation $t_I = f(T_\omega)$ for them is shown in Fig.9. There are 9 figures and 8 references; 3 of the references are Soviet, 3 are English and 2 German.

ASSOCIATION: Akademiya nauk SSSR, Institut fiziki Zemli (Institute of Physics of the Earth)

SUBMITTED: August 30, 1957.

GOLITSYN, Boris Borisovich [deceased, 1862-1916]; PREDVODITELEV, A.S., otv. red.toma; BOCHKOVSKIY, V.F., prof., red.; GORSHKOV, G.P., prof., red.; KIRNOS, D.P., prof., red.; SAVARENSKIY, Ye.F., prof., red.; SAVARENSKIY, Ye.F., prof., red.; VVEDENSKAYA, A.V., kand.fiz.-mat. nauk, red.; VESHNYAKOV, N.V., kand.fiz.-matem.nauk, red.; LEVITSKAYA, A.Ya., kand.fiz.-matem.nauk, red.; LINDEN, N.A., kand.fiz.-matem. nauk, red.; FILIPPOV, L.P., kand.fiz.-matem.nauk, red.; KHARIN, D.A., kand.fiz.-matem.nauk, red.; ALEKSEYEV, D.M., red.izd-va; MARKOVICH, S.G., tekhn.red.

[Selected works] Izbrannye trudy. Moskva, Izd-vo Akad.nauk SSSR. Vol.1. [Physics] Fizika. 1960. 241 p. (MIRA 13:11)

1.Chlen-korrespondent AN SSSR (for Predvoditelev).
(Physics)

GOLITSYN, Boris Borisovich, akademik; BONCHKOVSKIY, V.F., prof., otv.red.II toma; PREDVODITELEV, A.S., otv.red.I toma; GORSHKOV, G.P., prof., red.; KIRNOS, D.P., prof., red.; SAVARENSKIY, Ye.F., prof., red.; VVEDENSKAYA, A.V., kand.nauk, red.; VESHNYAKOV, N.V., kand.nauk, red.; LEVITSKAYA, A.I., kand.nauk, red.; LINDEN, N.A., kand.nauk, red.; FILIPPOV, L.P., kand.nauk, red.; KHARIN, D.A., kand.nauk, red.; ALEKSEYEV, D.M., red.izd-va; KASHINA, P.S., tekhn.red.

[Selected works] Izbrannye trudy. Moskva, Izd-vo Akad.nauk SSSR. Vol.2. [Seismology] Seismologiia. 1960. 489 p.
(MIRA 13:12)

1. Chlen-korrespondent AN SSSR (for Predvoditelev).
(Seismology)

S/619/61/000/016/002/005
D055/D114

AUTHORS: Kirnos, D. P.; Rulev, B. G.; Kharin, D. A.

TITLE: The VEGIK seismograph, designed for engineering seismology work and the registration of near earthquakes

SOURCE: Akademiya nauk SSSR. Institut fiziki Zemli. Trudy, no. 16 (183), Moscow, 1961. Voprosy inzhenernoy seysmologii, no. 4, 32-56

TEXT: This is a description of the ВЭГИК (VEGIK) seismograph, elements of its theory, methods of determining its constants and examples of the use of the device in engineering seismology and the recording of weak local earth tremors. The main purpose of the seismograph was the study of the seismic effects of explosions, but the device has also found wide application in related fields. It has galvanometric registration and magnetic attenuation and may be used for recording horizontal and vertical vibrations. The diagram of the seismic receiver is shown in fig. 1. Vibrations are recorded with the aid of ГК-VI (GK-VI) or GK VII galvanometers, small mirror galvanometers or ordinary loops. In engineering seismology ПОБ-9 (POB-9), ПОБ-12 (POB-12) and ПОБ-14М (Н-700) [POB-14M (N-700)] oscillographs or other

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The VEGIK seismograph ...

magnetoelectric oscillographs are used. For recording earth tremors the ordinary PE -II (RS-II) registering apparatus is used with a higher moving speed of the photo-paper of 120-240 mm/min. When the seismograph is operating at 1-50 c/s there are no parasitic resonances. Formulae are discussed for calculating displacement, rates of movement of objects and acceleration during vibrations in the ground or buildings. Basic and simplified methods of determining the constants of the VEGIK seismograph are examined. Accounts are given of how the VEGIK seismograph was used to observe vibrations during underground explosions with the purpose of ascertaining safe distances for engineering installations from mass industrial explosions, to study vibrations in reinforced-concrete dams and in turbo-generators, and to record earth tremors. There are 18 figures, 1 table and 12 Soviet references.

S/619/61/000/016/002/005
D055/D114

The VEGIK seismograph ...

Legend:

1 - pendulum
2 - steel plates forming axis of rotation of pendulum
3 - pendulum supports
4 - steel screw spring
5 - screw regulating pendulum's equilibrium
6 - device regulating angle of the spring
7 - light plexiglass cylinder wound with two coils of thin enameled copper wire
8 - permanent magnet with a coil in the cylindrical air gap

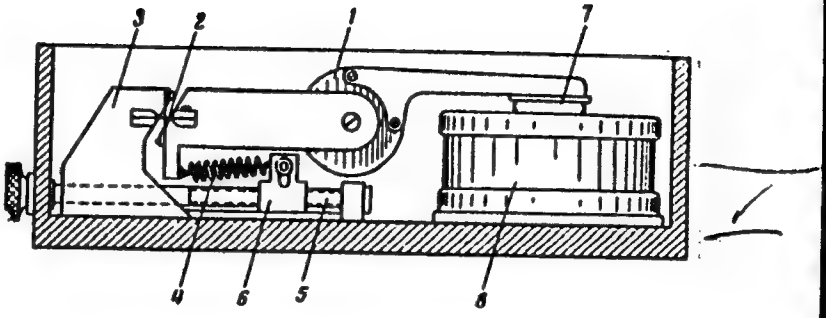

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Fig.1. Diagram of the VEGIK seismograph

S/049/61/000/005/004/013
D218/D306

AUTHORS: Arkhangel'skiy, V.T., Kirnos, D.P., Popov, I.I., and Solovyev, V.N.

TITLE: Preliminary observations of long-period seismic waves at the Simferopol' station

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya geofizicheskaya, no. 5, 1961, 670-675

TEXT: This paper was first read at a seminar on surface waves which was held in the Department of Seismology and Seismic Service on October 1 - 5, 1960, at Simferopol'. The authors briefly report on a prototype vertical seismograph which was designed for detecting seismic waves with periods between 20 and 300 sec. The instrument is a modification of a vertical seismograph designed in 1959 in the Department of Seismology of the Institute of Physics of the Earth AS USSR. The modification was carried out in accordance with the recommendations given by the first of the present authors (Ref. 6: Izv. AN SSSR, ser. geofiz., no. 10, 1960). The pendulum

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Preliminary observations of ...

employed is illustrated schematically in Fig. 1. The reduced length of this arrangement is l_1 = 0.742 m and the moment of inertia is K_1 = 0.381 kg.m^2. The flat spring is made of elinvar which has a positive temperature coefficient of frequency (22 x 10^{-6}). The long-period galvanometer was made at the Seismometric Laboratory of the Department of Seismology and Seismic Service, Institute of Physics of the Earth, AS USSR. The period of the galvanometer may be adjusted to between 80 and 130 seconds. Its current constant is 2.2 x 10^{-10} amp/mm at one meter, and its electromagnetic damping constant is 72 ohms. The moment of inertia of the galvanometer frame is K_2 = 8.63 x 10^{-7} kg.m^2. The seismograph has been used to record long-period surface Rayleigh waves with periods in excess of 30 sec. Interesting results are said to have been obtained for Rayleigh waves due to the Chile earthquake of May 22, 1960. Waves with periods up to 480 sec were recorded. There are 5 figures, 1 table and 8 references: 3 Soviet-bloc and 5 non-Soviet-bloc. The 4 most recent references to English-language publications read as

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S/049/61/000/005/004/013
D218/D306

Preliminary observations of ...

follows: H. Benioff, F. Press, Progress report on long period seismographs. Geophys. J. Roy. Astr. Soc., 1, no. 3 (1958); M. Ewing, F. Press, Further study of atmospheric pressure fluctuations recorded on seismographs. Trans. Amer. Geophys. Union, 34, (1953); F. Press, M. Ewing, F. Lehner, A long period seismograph system. Trans. Amer. Geophys. Union, 39, no. 1 (1958); M. Ewing, W. Jardetzky, F. Press, Elastic waves in layered media (1957).

ASSOCIATION: Akademiya nauk SSSR, Institut fiziki zemli (Academy of Sciences USSR, Institute of Physics of the Earth)

SUBMITTED: December 17, 1960

Card 3/4 3

S/169/62/000/002/014/072
D228/D301

AUTHORS: Kirnos, D. P. and Rykov, A. V.

TITLE: Special rapid-action seismic apparatus for announcing tsunami

PERIODICAL: Referativnyy zhurnal, Geofizika, no. 2, 1962, 11-12, abstract 2A76 (Byul. Soveta po seysmol. AN SSSR, no. 9, 1961, 56-66)

TEXT: Versions of the apparatus for the rapid (3 - 4 min) determination of the epicenters of catastrophic earthquakes (УБОПЭ-1 (UBOPE-1) equipment) and the epicenters of earthquakes (УБОПЭ-2 (UBOPE-2) equipment) have been developed. Each contrivance consists of two instruments: one azimuthograph shows the direction to the epicenter, while the other indicates the magnitude of the epicentral distance and the force of the earthquake. The UBOPE-1 azimuthograph includes two mutually-perpendicular horizontal pendulums, and the UBOPE-2 azimuthograph is a pendulum with two degrees of freedom. The pen connected to the pendulums registers the line

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of azimuth on a smoked paper or plate, and a special optical appliance projects it onto a mat screen with a scale. A ВЭГИК (VEGIK) vibrograph is used for synonymously determining the direction. In the UBOPE-2 the recording is made on luminescent paper with a post-luminescence of 30 min, which corresponds to the time of one revolution of the recorder drum. The magnification of the UBOPE-1 and UBOPE-2 azimuthographs equals 25 and 500 respectively. Two mutually-perpendicular horizontal СМР-3 (SMR-3) seismographs (a magnification of 2 and a natural oscillation period of 3 sec) are used in the UBOPE-1 to determine the epicentral distance and the earthquake force. An astatic pendulum with two degrees of freedom, whose movement is resolved into two mutually-perpendicular directions, is used in the UBOPE-2 (the system's magnification is 50, the period of natural oscillations being 4 sec). There is an optical device which allows the difference in the arrival time of the transverse and the longitudinal wave, and the oscillation amplitude, to be read off without removing the tape. The analysis of two tsunami earthquakes recorded by the UBOPE-1 testifies to the

S/169/62/000/002/014/072
D228/D301

Special rapid-action ...

desirability of decreasing the sensitivity of the SMR-3 seismo-graph by 4- to 5-fold. [Abstracter's note: Complete translation.]

Card 3/3

S/619/61/000/019/001/C19
D039/D112

3.9300 (1019,1327)

AUTHORS: Yeh Shih-yüan, Kirnos, D.P., Solov'yev, V.N.

TITLE: A simplified recording unit for instrumental observations in epicentral zones of strong earthquakes

SOURCE: Akademiya nauk SSSR. Institut fiziki Zemli. Trudy, no. 19 (186). Moscow, 1961, Seysmicheskiye pribory, 5-11

TEXT: The authors describe an YAP' (UAR) recording unit for making time recordings of various seismic processes in the epicentral zones of strong earthquakes. It is automatically started at the beginning of an earthquake and stops after one minute, the average period of a local earthquake. It consumes power only when recording, and is always ready for operation. It consists of the following units, mounted on a single base: (1) three accelerometers, velocity meters, or seismometers of the same design as those used in the СР30 (SR20) device developed by the IFZ, AS USSR for recordings at Soviet seismic stations; (2) a special recorder with a film or photographic paper; (3) a starting seismoscope in the form of a vertical pendulum with two degrees of freedom. Calculation of the chart mechanism is given

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S/619/61/000/[illegible]/001/019
9059/D11-

A simplified recording unit for .....

Laboratory tests of a working model of the device showed that: (1) it is started by an earthquake of a predetermined intensity. If no earthquake of the given intensity takes place, the unit can remain ready for recordings for up to 1 year; (2) the uniform tape speed of about 10 mm/sec is reached 0.03 - 0.0[illegible] sec after the arrival of a seismic wave, while the luminaire lamp lights up even sooner; (3) seismic receivers with optical and galvanometric recording systems enable the unit to photographically record various elements of ground movements during earthquakes with an intensity of more than 3 points; (4) power is supplied from a 6 v and a 100-v dry battery and is consumed only during the recording process; (5) the unit is sufficiently simple, reliable and cheap, and can therefore be used in large-scale seismometric observations of strong earthquakes. The AVC (USA) and CGM (USSR) seismoscope-type devices are mentioned as simple and cheap devices now used in seismic observations. There are 3 figures and 5 references: 2 Soviet-bloc and 3 non-Soviet-bloc. The three references to English-language publications read as follows: N.H. Heck, Civil Engin. [illegible], N 1, 1942; F.P. Ulrich Progress report

IX

Card 2/3

S/619/61/000/019/021/029
D039/D112

A simplified recording unit for .....

of Seism., work by U.S. CGS western U.S. during 1943. Bull. Seism. Soc. of Am. 34, 1944; R. Takahasi. The SMAC strong motion accelerograph and other latest instruments for measuring earthquakes and building vibrations. Proc. of World Conference on Earthquake Engineering, June 1956.

X

Card 3/3

S/263/62/000/011/008/022
I007/I207

AUTHOR: Kirnos, D. P. and Solov'yev, V. N.

TITLE: Seismograph for optical recording of strong, destructive earthquakes

PERIODICAL: Referativnyy zhurnal, otdel'nyy vypusk. 32. Izmeritel'naya tekhnika, no 11, 1962, 22, abstract 32.11.164. "Tr. In-ta fiz. Zemli, AN SSSR", no. 19 (186), 1961, 25-36

TEXT: Soviet and foreign devices for recording vibrations of soil and structures during strong earthquakes are critically examined and it is shown that certain deficiencies in the method of measurement-recording do not permit these devices to be used as standard recorders at seismographic stations. Description is given of a new type of seismograph designed by the Institut Fiziki Zemli AN SSSR (Institute of Geophysics of the AS of the USSR), having an improved automatic recording system. The seismograph records different components of acceleration, velocity and displacement of soil. The sensing device of the seismograph is an elastic pendulum made of an aluminum plate located in the air gap of a permanent magnet and fastened to a steel wire that forms the rotation axis of the pendulum. The latter is provided with a flat mirror for beaming the light of a special lamp through a focusing lens, to the photographic paper fixed to a rotating drum. The rotational speed of the drum driven by a spring gear is 5 or 10 mm/sec. An electrical, battery-fed device ensures connection or disconnection of the seismograph at the beginning of an earthquake and the end of recording. There are 6 figures and 7 references.

[Abstracter's note: Complete translation.]

Card 1/1

S/619/61/000/019/015/019
D039/D112

AUTHORS: Kirnos, D.P.; Moskvina, A.G.; Shebalin, N.V.

TITLE: On the selection of rational methods of determining the constants of electrodynamic seismographs

SOURCE: Akademiya nauk SSSR. Institut fiziki Zemli. Trudy, no. 19 (186). Moscow, 1961, Seysmicheskiye pribory, 91-112

TEXT: Rational methods of determining the constants T_1, T_2, D_1, D_2, σ^2 and $\overline{V}$ of the pendulum-galvanometer system of an electromagnetic seismograph are proposed. These constants entirely determine the form of the frequency and phase response and are accepted at Soviet seismic stations as the basic constants of seismographs. The period of free oscillations of the galvanometer T_2 can be determined by a seconds timer with an error of not more than 1%, when the oscillation periods of the frame of the galvanometer are short, it is recommended to determine T_2 by recording the free oscillations of the frame on photographic paper. The pendulum period T, was found for the СВК (SVK), ВСХ (VSKh) and ВЭГИК (VEGIK) seismographs. The measurement of

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S/619/61/000/019/015/019
D039/D112

On the selection ...

T_1 should be done at $\sigma^2 \leq 0.1$ and at $\vartheta \leq 10^{-3}$. Since direct visual determination of T_1 at $\vartheta < 10^{-3}$ is difficult, the motion of the pendulum must be measured by a galvanometer connected through a sufficiently high resistance ensuring very slight damping of the pendulum. In order to find the damping of the pendulum D_1, and that of the galvanometer D_2, the corresponding mechanical dampings D_{10} and D_{20} and the electrodynamic coefficient α_2 for the galvanometer and α_{11} and α_{12} for the pendulums must be known. The value D_{20} is found by recording the free oscillations of the frame of the galvanometer by means of a formula. The coefficient α_2 is determined by a conventional method proposed by B.B. Golitsyn (Ref.6: (Lektsii po seysmometrii) Izbr. trudy, [Lectures on seismometry, selected works] 2. Izd-vo AN SSSR, 1960). The value D_2 is determined from the recording of the damped oscillations of the galvanometer shunted across a known resistor $R_{external}$. The determination of α_{11}, α_{12} and D_{10} requires three equations, i.e. three recordings with different external resistances. To make this method more convenient, only two recordings for each coil of the pendulum were made. Circuit diagrams for both recordings are given. The value D_1 is calculated by imparting a pulse to the pendulum and recording

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On the selection ...

its damped oscillations. The coupling factor δ^2 is calculated for two cases: (1) when two additional resistors are switched between the pendulum and galvanometer; (2) when $R_1 = R_2 = 0$ and $r = \infty$. The formulae for both cases are given. The magnification $\overline{V}$ is best determined by a calculation method requiring that the moment of inertia of the galvanometer K_2, the moment of inertia of the pendulum K_1 and the given length of the pendulum l_1 be known. The value K_2 is determined by a method described by V.T. Arkhangel'skiy (Ref. 3: Rukovodstvo po proizvodstvu i obrabotke nablyudeniy na seysmicheskikh stantsiyakh SSSR [Manual for Carrying out and Processing Observations at Seismic Stations of the USSR] Izd-vo AN SSSR, 1954). For determining K_1 and l_1 with an error not above 1%, a method of swinging the pendulum on special knife bearings is proposed. Formulae are also given for calculating the magnification curve of a seismograph. The maximum magnification V_m and the corresponding value of the period of oscillations T_m can be determined from this curve. It is concluded that the values l_1, K_1, T_1, T_2, D_{20} and α_2, the galvanometer current constant P_2, the air damping of the pendulum D_{10} and its electrodynamic coefficients α_{11} and α_{12} can be

Card 3/4

found directly. The values l_1 and K_1 should be determined during manufacture of the pendulum and indicated on its rating plate. The values D_1, D_2, K_2, σ^2 and $\overline{V}$ are determined by means of calculations. The authors thank V.T. Arkhangel'skiy, Candidate of Physics and Mathematics, I.I. Popov, Director of the seysmicheskaya stantsiya Simferopol' (Simferopol' Seismic Station) and its scientific workers Z.I. Aronovich and S.K. Novak who participated in the experiments and the discussion of results. There are 5 figures, 5 tables and 9 Soviet-bloc references.

PHASE I BOOK EXPLOITATION SOV/6029

Arkhangel'skiy, V. T., D. P. Kirnos, A. G. Moskvina, V. N. Solov'yev, N. Ye. Fedoseyenko, V. M. Fremd, and N. V. Shebalin

Apparatura i metodika nablyudeniy na seysmicheskikh stantsiyakh SSSR (Apparatus and Observation Methods at Seismic Stations in the USSR) Moscow, Izd-vo AN SSSR, 1962. 166 p. Errata printed on inside back cover. 1500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Sovet po seysmologii.

Resp. Ed.: D. P. Kirnos, Doctor of Physics and Mathematics; Ed. of Publishing House: V. M. Fremd; Tech. Eds.: I. A. Makogonova and S. Golub'.

PURPOSE: This book is intended primarily for personnel of Soviet seismic stations.

COVERAGE: The book consists of three sections. Section I, written by V. T. Arkhangel'skiy, deals with the elementary theory of seismographs. A description of the basic types of seismographs already in use in the Soviet Union is

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presented in Section II, which was compiled by D. P. Kirnos and A. G. Moskvina. Section III was written by A. G. Moskvina, V. M. Fremd, and N. V. Shebalin and deals with the methods and technique of seismic observation. In addition to the authors named above, the following persons, all members of the Institut fiziki Zemli im. O. Yu. Shmidta AN SSSR (Institute of Physics of the Earth, imeni O. Yu. Shmidt Academy of Sciences USSR), took part in the preparation and discussion of the manuscript: N. Ye. Fedoseyenko, V. N. Solov'yev, Z. I. Aronovich, I. L. Nersesov, I. I. Popov, and D. A. Kharin. There ar 28 references, all Soviet.

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BORISEVICH, Ye.S.; KIRNOS, D.P.

"Instruments for the measurement and recording of vibrations" by T.A.Gevondian, L.T.Kiselev. Reviewed by E.S.Borisevich D.P.Kirnos. Priborostroenie no.2:32 F '63. (MIRA 16:5)
(Vibration—Measurement) (Gevondian, T.A.) (Kiselev, L.T.)

KIRNOS, D. P.

New devices for recording and analyzing the registrations of severe earthquakes. Biul. Sov. po seism. no.14:39-48 '63. (MIRA 16:4)

(Seismometers)

KIRNOS, D.P.; KOLESNIKOV, Yu.A.; RYKOV, A.V.

Instrument analysis of seismograms. Trudy Inst. fiz. Zem. no.26:3-15 '63. (MIRA 16:11)

KIRNOS, D.P.; KOLESNIKOV, Yu.A.; KOGAN, L.A.

Instrument determination of engineering spectra. Trudy Inst. fiz. Zem. 28 Vop. inzh. seism. no.8:104-116 '63. (MIRA 16:11)

KIRNOS, D.P.; KOLESNIKOV, Yu.A.; RYKOV, A.V.

Use of instrumental methods in analyzing seismograms. Biul.Sov. po seism. no.15:139-145 '63. (MIRA 17:4)

ARKHANGEL'SKIY, V.T.; KIRNOS, D.P., dr. fiziko-matem. nauk

General type wide-band seismographs. Trudy Inst. fiz. Zem. no.35: 3-11 '64. (MIRA 17:12)

KIRNOS, D.P., doktor fiz.-matemat.nauk

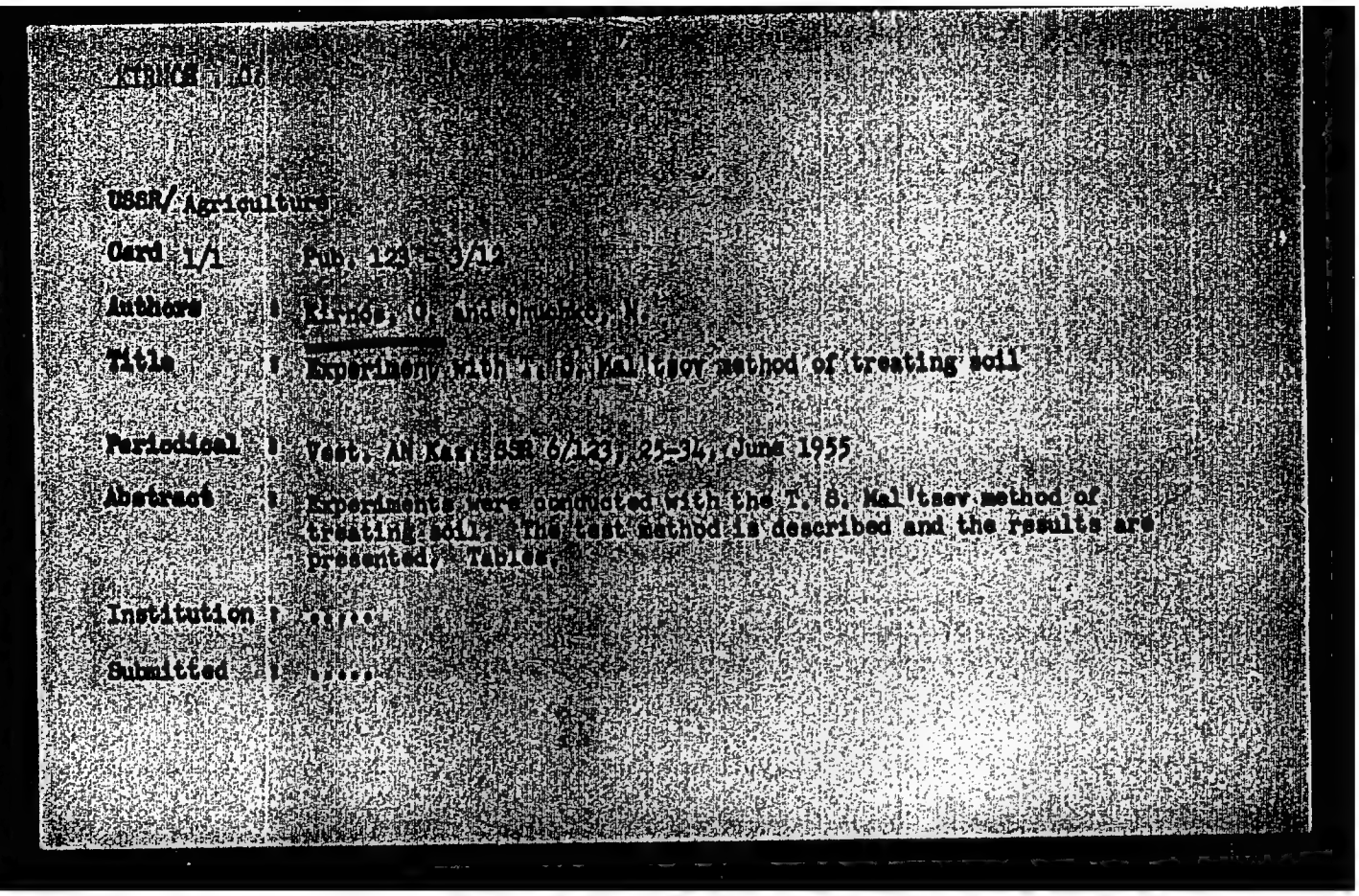
Conference on the standardization of seismic observations held in the German Democratic Republic. Vest.AN SSSR 35 no.8:70 Ag '65. (MIRA 18:8)

KIRNOS, G. V. and CHUCHKO, N. I.

"Questions in Connection with the Reclamation of Virgin and Fallow Lands in the Kustanay Region," Agrobiologiya No.3, pp. 15-24, 1955

Karabalyk Syaye Plant-Breeding Station

Translation 2030158



USSR/ Agriculture

Card 1/1 Pub. 123 - 3/12

Authors : Rivnis, O. and Gruzdev, N.

Title : Experiments with T. S. Mal'tsev method of treating soil

Periodical : Vest. AN Kaz. SSR 6/123, 25-34, June 1955

Abstract : Experiments were conducted with the T. S. Mal'tsev method of treating soil. The test method is described and the results are presented. Tables.

Institution : .....

Submitted : .....

KIRNOS, G.V.; CHUCHKO, N.I.

Deep subsoiling as a prospective tillage method. Zemledelie 4 no.5:40-42 My '56. (MLRA 9:8)

1. Karabalykskaya gosudarstvennaya selektsionnaya stantsiya. (Kazakhstan--Tillage)

KIRNOS, G. V.: Master Agric Sci (diss) -- "Problems in the basic working of the soil on chernozems of Kustanay Oblast". Leningrad, 1958. 24 pp (All-Union Order of Lenin Acad Agric Sci im V. I. Lenin, Agrophysical Sci Res Inst), 150 copies (KL, No 5, 1959, 153)

KIRNOS, G.V.

Cultivation of virgin lands in Kustanay Province. Agrobiologiia no.6:98-105 N-D '58. (MIRA 12:1)

1.Kustanayskaya sel'skokhozyaystvennaya opytnaya stantsiya.
(Kustanay Province--Agriculture) (Tillage)

ISHUTINOV, D.V., inzh.; POLYAKOV, V.Ya., inzh.; KIRNOS, I.V., inzh.

Results of studying a model of the N-300-1,23 centrifugal supercharger. Teploenergetika 12 no.5:44-48 My '65. (MIRA 18:5)

1. Ural'skiy turbomotornyy zavod.

KIENOS, Lazar' Nisonovich; PANFILOV, N.D., red.; IVANOVA, L.A., tekhn. red.

[Operation of stationary motion-picture projectors] Ekspluatatsiia statsionarnykh kinoproektorov. Moskva, Obs. izd-vo "Iskusstvo," 1957. 166 p. (Biblioteka kinomekhanika, no.1). (MIRA 11:7)
(Motion-picture projection)

KIRNOS, P. I.

"Geography of the Agricultural Settlement in Voronezhskaya Oblast in Connection With Peculiarities of the Development and Disposition of Agriculture." Cand Geo; Sci, Voronezh State U, Voronezh, 1954. (KL, No 12, Mar 55)

SO: Sum. No. 670, 29 Sep 55-Survey of Scientific and Technical Dissertations Defended at USSR Higher Educational Institutions. (15)

KIRNOS, T. V.

SHUVALOV, G.T.; KIRNOS, T.V.

Rate of wireworm infestations in fields tilled by T.S. Mal'tsev's method. Agrobiologiia no.2:124-125 Mr-Ap '57. (MLRA 10:5)

1.Kustanayskiy opornyy punkt Vsesoyuznogo instituta zashchity rasteniy, Karabalykskaya gosudarstvennaya selektsionnaya stantsiya.
(Karabalykskiy District--Wireworm)
(Tillage)

FRENKEL', V.Kh.; KIROSHKA, M.V.

Isotope renography using J^{131}-labelled hippuran and J^{131}-labelled cardiotrast in urolithiasis. Med. rad. 10 no.9:39-42 S '65.
(MIRA 18:10)

1. Urologicheskaya klinika (zav. - doktor med.nauk S.D.Goligorskiy) Kishinevskogo meditsinskogo instituta i rentgeno-radiologicheskiy tsentr (zav. L.Ye.Kishinevskiy) Respublikanskoy klinicheskoy bol'nitsy Moldavskoy SSR.

BELASH, F.N., prof.; KHARLAMOV, V.S., kand. tekhn.nauk
KIRNOSOV, E.G., inzh.

Middlings of the Kamsh-burun factory as a subject for gravity concentration. Izv. vys. ucheb. zav.; gor. zhur. no.4:146-151 '61. (MIRA 14:6)

1. Rekomendovana kafedroy obogashcheniya poleznykh iskopayemykh Krivorozhskogo gornorudnogo instituta. 2. Krivorozhskiy gornorudnyy institut (for Belash, Kharlamov, Kirnosov). 3. Kamyshburunskiy zhelezorudnyy kombinat (for Burova).
(Kerch Peninsula--Ore dressing)

KIRNOSOV, Grigoriy Semenovich

[Sampling ores, their concentrates and sinters] Oprobovanie rud, ikh kontsentratov i aglomeratov. Moskva, Metallurgiia, 1965. 164 p. (MIRA 18:12)

KIRNOSOV, V.I.

Defects of tensile-testing machines designed for limited-range measurements. Izm. tekh. no.5:52-53 S-O '55. (MLRA 9:1)
(Testing machines)

KIRNOSOV, Vladimir Ivanovich; YANOVSKIY, Il'ya Iosifovich; IZOSIMOVA, O.B., inzhener, redaktor; UDAL'TSOV, A.N., glavnyy redaktor

[Universal apparatus for determining the hardness of metals] Universal'nye pribory dlia opredeleniia tverdosti metallov. Tema 2. Moskva, Akademiia nauk SSSR, 1956. 23 p. (MLRA 10:1)
(Testing machines)

KIRNOSOV, V. I.

Call Nr: TA 413.R8

AUTHOR: None given

TITLE: Specification 235-56 for the Verification of Devices for Determining the Hardness of Metals (Instruktsiya 235-56 po poverke priborov dlya opredeleniya tverdosti metallov)

PUB. DATA: Standartgiz, Moscow, 1956, official ed., 55 pp., 5,000 copies

ORIG. AGENCY: Komitet standartov, mer i izmeritel'nykh priborov pri Sovete Ministrov SSSR

EDITOR: Ed.: Kirnosov, V. I.

PURPOSE: Specification 235-56 supersedes specification 55-49. It is meant for organizations and enterprises engaged in the verification of hardness testers.

COVERAGE: Specification 235-56 was developed by the Novosibirskiy gosudarstvennyy institut, mer i izmeritel'nykh priborov, and was approved by the Komitet standartov, mer i izmeritel'-nykh priborov, at the Sovet Ministrov SSR in regulation Nr 217

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Specification 235-56 for the Verification of Devices for Determining the Hardness of Metals (Cont.)

Apr. 29, 1956, effective Sept. 1, 1956. This specification determines the means and methods for the verification of hardness testers which are being used, manufactured, or repaired.

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Call Nr: TA 413.R8

Specification 235-56 for the Verification of Devices for Determining the Hardness of Metals (Cont.)

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AVAILABLE: Library of Congress

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KIRNOSOV, V.I., red. KUZNETSOVA, M.A., red. izd-va; KONDRAT'YEVA, M.A., tekhn. red.

[Instructions 236-56 for checking strain gauges] Instruktsiia 236-56 po poverke tenzometrov. Izd. ofitsial'noe. Moskva, 1957. 22 p. (MIRA 14:5)

1. Russia(1923- U.S.S.R.) Komitet standartov, mer i izmeritel'nykh priborov.
(Strain gauges--Testing)

CHICHINADZE, Avtandil Vissarionovich; TROYANOVSKAYA, Galina Yosifovna; TUCHKOVA, L.K., inzh., ved. red.; KIRNOSOV, V.I., inzh., red.; SMIRNOV, P.M., tekhn.red.

[Temperature range, coefficient of friction, and wear of pairs of sliding surfaces] Temperaturnoe pole, koeffitsient treniia i iznos friktsionnykh par. Moskva, Filial Vses. in-ta nauch. i tekhn. informatsii, 1957. 26 p. (Peredovoi nauchno-tekhnicheskii i proizvodstvennyi opyt. Tema 20, no.M-57-127/6) (MIRA 11:12)

(Friction)

KIRNOSOV, VLADIMIR IVANOVICH

AUTHOR: Dement'yev, Kh.N., Candidate of Technical Sciences SOV/32-24-9-52/53

TITLE: V.I. Kirnosov and I.I. Yanovskiy. Machines and Apparatus for Material Testing (V.I. Kirnosov i I.I. Yanovskiy. Mashiny i pribory dlya ispytaniya materialov) Mashgiz, 300 Pages, 1957, 11.65 Roubles (Mashgiz, 300 str., 1957 g., 11 r. 65 kop.)

PERIODICAL: Zavodskaya Laboratoriya, 1958, Vol 24, Nr 9, pp 1167-1167 (USSR)

ABSTRACT: The book mentioned in the title is discussed. It contains 5 chapters and 128 figures. There are, however, no machines for testing the fatigue among those mentioned in this book. It is suggested for laborers in the laboratories of works, as well as for state employed supervisors and workers who deal with repair works and checking of testing machines and apparatus. It is mentioned that the book should have dealt with some generalizations in the interpretation of theoretical basic concepts, constructional details, repair works etc. The plan of the machine P - 5 in figure 20 in this book does not agree with its description. There are a few more of such faults; they are mentioned. It is pointed out that in the case of a new edition of this book the descriptions of the

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V.I. Kirnosov and I.I. Yanovskiy. Machines and Apparatus for Material Testing. Mashgiz, 300 Pages, 11.65 Roubles SOV/32-24-9-52/53

machines should be cut and the faults mentioned should be corrected.

Card 2/2

KIRNOSOV, V.I., red.; KUZNETSOVA, M.I., red.izd-va; KONDRAT'YEVA, M.A., tekhn.red.

[Instructions 233-56 for the checking of tension, compression, bending, and torsion testing-machines] Instruktsiia 233-56 po poverke mashin dlia ispytaniia materialov na rastiazhenie, szhatie, izgib i kruchenie. Izdanie ofitsial'noe. Moskva, 1958. 44 p. (MIRA 12:4)

1. Russia (1923- U.S.S.R.) Komitet standartov, mer i izmeritel'nykh priborov.
(Testing-machines)

KIRNOSOV, V.I., red.; KUZMETSOVA, M.I., red.izd-va; KASHIRIN, A.G., tekhn.red.

[Instruction 235-56 on the verification of instruments for the determination of metal hardness] Instruktsiia 235-56 po poverke priborov dlia opredeleniia tverdosti metallov. Izd.ofitsial'noe. Moskva, 1959. 55 p. (MIRA 13:11)

1. Russia (1923- U.S.S.R.) Komitet standartov, mer i izmeritel'nykh priborov.
(Hardness--Testing) (Metals--Testing)

AUTHOR: Kirnosov, V. I., Engineer SOV/28-59-1-3/29

TITLE: The Standardization of Machines and Apparatuses for Testing the Mechanical Properties of Metals (Standartizatsiya mashin i priborov dlya ispytaniya mekhanicheskikh svoystv metallov)

PERIODICAL: Standartizatsiya, 1959, Nr 1, pp 10 - 14 (USSR)

ABSTRACT: Problems of standardizing the machines and apparatus for testing the mechanical properties of metals are here discussed. A project for an industrial series of testing machines, serving as a base for classification standards, was elaborated by NIIVESPROM in 1955. The nomenclature of testing machinery was elaborated (beginning in 1958) by the Institute in cooperation with competent material testers; this nomenclature will be included in the plan for 1959-1965. A number of defects were fixed by testing the IP-4M machine for metal creep and fire resistance. The swing drivers for testing the shock resistance of metals should be standardized in the near future, as well as the device for measuring the deformation of loaded mechanisms. Standardization of the testing method should be carried out

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The Standardization of Machines and Apparatuses for Testing the Mechanical Properties of Metals

first. The elaboration of standards has to be in accord with international recommendations. The standard method for testing the metal hardness according to Rockwell, Brinell and Vickers, was elaborated by TsNIIChERMET with reference to ISO TK/17 recommendations. The Committee of Power of NTO Mashprom organized a scientific technical conference to discuss a machine for the statical testing of material characteristics, and on the standardization of testing methods. The organic conjunction between the standards and the assortment of metals, of testing methods and requirements in the testing of machinery should be taken into consideration. The testing up of genernal machine-classification standards based on the preference series should precede the standardization of particular groups. There are 2 Soviet references.

SOV/28-59-1-3/29

The Standardization of Machines and Apparatuses for Testing the Mechanical Properties of Metals

ASSOCIATION: VNII Komiteta standartov, mer i izmeritel'nykh priborov (The All-Union Scientific Research Institute of the Committee of Standards, Measures and Measuring Devices)

Card 3/3

AKOL'ZIN, P.N.; ARAKEL'YANTS, N.M.; BUYANOVA, O.A.; KIRNOSOV, V.I.; KISELEVSKIY, S.L.; TARAPIN, V.N.; SHCHEDROVITSKIY, S.S.; EYDEL'MAN, R.Ya.

Unified series of strain gauges for the automation of construction and road machinery. Priborostroenie no.8:11-12 Ag '62. (MIRA 15:9)

(Strain gauges)

BURYAKOV, V.S., tekhnik; PETRUKOVICH, V.D., inzh.; KIRNOV, Ye.S., inzh.; METEL'NIKOV, V.I., inzh.; KUDRYASHOV, S.A., inzh.

Concerning V.V.Vasil'ev's article "Should equipment be grounded or reliably insulated?". Energetik 10 no.12:15-17 D '62. (MIRA 16:1)

(Electric lines—Overhead)

KIRNOV, Ye.S., inzh.

Concerning D.S. Batrakov's article "Fastening of 6 to 10 kv. dischargers with the power line on the same hook." Energetik 11 no.6:21 Je '63. (MIRA 16:7)

(Electric lines—Overhead)
(Electric portection)
(Batrakov, D.S.)

S/007/61/000/007/003/004
B103/B217

AUTHORS: Ivanova, V. F., Kirnozov, F. F.

TITLE: Application of neutron methods to the geochemical detection of boron concentrations and the analysis of ores from boron deposits

PERIODICAL: Geokhimiya, no. 7, 1961, 604-609

TEXT: The authors discuss the application of the neutron method to the geochemical detection of boron concentrations as well as to the analysis of ores from boron deposits. This method was suggested by the collaborators of their institute and is based upon the recording of secondary gamma radiation or the density of thermal neutrons in the borehole during the irradiation of rocks by fast neutrons. The method permits a clear separation of boron-containing rocks and a quantiative determination of contents up to 2-3% (Ref. 5: V. F. Ivanova, V. K. Khristianov. Geokhimiya, 2,1956; Ref. 6: V. F. Ivanova, Razvedka i okhrana nedr (Prospecting and protection of mineral resources),6,1958). The method is suited for geochemical detection as well as for the detection of deposits. The method

Application of neutron methods ...

was improved, and it is now also suited for rocks with a content higher than 2-3% B_2O_3. The decrease of the resolving power of the method at higher boron content is due to the "saturation", where the recorded intensity of secondary gamma radiation or the density of thermal neutrons does not rise any more with increasing boron content. The resolving power can be attained by recording neutrons of higher energies for which the capture cross section of boron is smaller. The authors developed their method on a deposit of halogen-sedimentary type. The boron ores are bedded in the 40-50 m thick gypsum cap of a salt dome. The beds of the boron ores were superimposed as well as subjacent to the waterbearing horizon (depth 24-43 m). The borate deposits belonged to two types: (1) Disseminations in argillaceous rocks (syngenetic separations of ulexite and hydroboracite, rarely colemanite and secondary "inoite" (in'cit) formations); (2) lenticular and bedlike borate deposits (syngenetic ascharite, sometimes with accompanying ulexite and pandermite as well as secondary "inoite" and carbonates). Previously, models of ore of different compositions were studied. The density of thermal neutrons was measured by proportional counters with boron fluoride filling, which were enriched

with B^{10}, as well as by means of scintillation counters (the latter were worked out at the Gosudarstvennyy opticheskiy institut im. S.I.Vavilova (State Optical Institute imeni S. I. Vavilov)). For recording epithermal neutrons, the above counters are wrapped in cadmium-paraffin filters which let through only such neutrons. Before measurements, the apparatus was calibrated (Ref. 9: V. V. Sulin, Etalonirovaniye apparatury radioaktivnogo karotazha (Standardization of apparatus for radioactive logging), Razvedochnaya i promyslovaya geofizika, 26,1958). A Po-Be neutron source of a strength of 1.5 curie polonium was used. μ was obtained as a function of the B_2O_3 content. μ is expressed by the relation

$$\frac{I_{St.D.} - I_{D.}}{I_{St.D.}},$$

where $I_{St.D.}$ is the neutron density from the subjacent bed of the rock and I_D the neutron density from the boron-containing beds. The resolving power of the method depends on the degree of alteration of μ with the change of the B_2O_3 content in the rock to be examined. The curves

Application of neutron methods ...

representing μ as a function of the B_2O_3 content in the rock determined on bed models are allowed to be used as standardization curves only with respect to the differences in chemical composition and density between model rocks and rocks occurring in the deposit. A standardization curve can be also obtained by numerous measurements in boreholes from beds with a known boron content. The errors of determination of the B_2O_3 content on the strength of standardization curves depends on the accuracy of measurements in the borehole as well as on the amount of the content to be determined. With equal accuracy of measurement in the borehole, the errors increase with the boron content. With an accuracy of measurement of ±5% in the borehole, the absolute error fluctuates from 0.6-0.8% at a B_2O_3 content of 2%, and up to 6-8% at a boron content of 15%. The relative error remains constant (30-40%). If the scintillation counter is used the counting level still to be recorded is approximately doubled with a reduction of the indicator to a third compared with the measurements by means of the proportional counter of thermal neutrons. Thus, measurements become more precise. The use of the cadmium-paraffin-cadmium filter on

the gamma counter leads to a relative increase of minima compared with the boron-containing beds, and doubles the counting level still to be recorded. This permits the use of neutron sources of lower strength. The authors conclude from a comparison of μ-values, measured on the one hand by means of different detectors, but calculated, on the other hand, on the strength of neutron diagrams that the μ-values for beds with different boron contents remain practically unchanged for all boron contents in thermal neutron recording. The value μ, however, changes proportionally to the boron content in the recording of neutrons of epithermal energies. This fact permits a determination of the boron content of the rock layers to be studied with sufficient accuracy of measurement in the borehole. There are 3 figures, 1 table, and 8 Soviet-bloc references.

ASSOCIATION: Institut geokhimii i analiticheskoy khimii im. V. I. Vernadskogo AN SSSR, Moskva (Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy of the AS USSR, Moscow)

SUBMITTED: March 8, 1961

ACC NR: AP7007599 SOURCE CODE: UR/0293/66/004/006/0871/0879

AUTHOR: Vinogradov, A. P.; Surkov, Yu. A.; Chernov, G. M.; Kirnozov, F. F.; Nazarkina, G. B.

TITLE: Preliminary results of measurements of gamma radiation of the lunar surface on the space station "Luna-10"

SOURCE: Kosmicheskiye issledovaniya, v. 4, no. 6, 1966, 871-879

TOPIC TAGS: lunar satellite, gamma spectrometer, cosmic radiation

SUB CODE: 22, 20,18

ABSTRACT: Experimental investigations of the intensity and spectral composition of gamma radiation of lunar rocks made using a gamma spectrometer carried aboard the automatic station "Luna-10" demonstrated that: 1) The general level of gamma radiation of lunar rocks approaches the level of gamma radiation over rocks of the earth's crust, somewhat exceeding the latter. According to a preliminary estimate, the intensity of the gamma radiation at the lunar surface is 20-30 μR/hour. 2) The principal contribution to lunar gamma radiation is from processes of the interaction of cosmic rays with lunar matter (instantaneous gamma radiation and the decay of cosmogenic isotopes). About 90% of the total lunar gamma radiation can be attributed to these processes. 3) Analysis made it possible to identify in the lunar spectrum photopeaks from gamma quanta emitted during the interaction of cosmic particles with the principal rock-forming elements of the lunar surface -- O, Mg, Al, Si -- and gamma quanta emitted during the decay of cosmogenic isotopes. 4) The results of measurements over different regions of the lunar surfaces, including the regions of the lunar "continents" and Seas" did not make

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TITLE: Measurement of gamma-radiation of the lunar surface by the Luna-10 spaceship [Paper presented at the Seventh COSPAR Meeting held in Vienna in May 1966]

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TOPIC TAGS: radiation measurement, gamma radiation, moon, lunar probe, scintillation spectrometer

ABSTRACT: The spaceship Luna 10, placed into a selenocentric orbit on 3 April 1966, was equipped with a 32-channel scintillation spectrometer to investigate the intensity and spectral composition of γ-radiation emitted from the lunar surface. The absence of an atmosphere sufficiently dense to absorb γ-rays makes it possible for a spaceship in lunar orbit to register γ-radiation. However, the counting rate measured from an orbiting spaceship decreases as a result of a decrease in the solid angle subtended by the visible surface

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of the Moon, which was 0.9° at periselene and 0.46° at aposelene in the initial orbit.

It is known that the content of natural radioactive elements (U, Th, K^{40}) in terrestrial rocks decreases from acidic to basic to ultrabasic rocks and that the decrease covers a range of several orders of magnitude. Therefore, it was expected that it would be possible to determine the type of rocks present in the lunar surface from the relative content of U, Th, and K established from the the γ-ray spectrum. In conducting the experiments, the fact that the level of γ-radiation from natural radioactive elements can be lower than the level of γ-radiation produced during the interaction of primary cosmic particles (primarily protons) with the lunar surface was taken into account by analyzing the characteristic γ-rays emitted during the interaction.

Instrumentation

The measurements were made with a scintillation spectrometer consisting of a 3 x 4-cm NaI(Tl) cylindrical crystal γ-ray detector with an FEU-16 photomultiplier and a pulse-height analyzer. To eliminate the back-

ground from charged particles, the NaI(Tl) crystal was enclosed in a container of a thin plastic scintillator. The pulses generated by charged particles were registered by the NaI(Tl) crystal and the plastic scintillator and were then separated from the pulses generated by γ-rays which went practically unregistered by the plastic scintillator.

The scintillation spectrometer recorded γ-ray spectra in the energy ranges between 0.3—3.1 and 0.15—1.5 Mev. The switching of energy ranges was performed by ground command. The detector and the analyzer of the spectrometer were located in a hermetically sealed compartment under a shell 1 g/cm^2 thick.

Experimental Results

Six γ-ray spectra in the energy range 0.3—3.1 Mev were obtained during the first month of operation of Luna 10. In addition, the integrated intensity of γ-radiation in the same energy range was obtained at approximately 15 points. The measurements were conducted over relatively wide surface areas covering the continents and the seas on both the light and the dark sides of the Moon. The height and the approximate selenographic coordinates

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of the regions above which the spectra were measured are given in Table 1.

Table 1. The Height Above the Lunar Surface and the Selenocentric Coordinates of the Regions Above Which Measurements Were Made

No. of spectrum	Date and time of measurement	Average height above surface	Selenographic latitude (Deg)		Selenographic longitude (Deg)	
			Start	End	Start	End
1	5 Apr 19 h 26 m	350	+70	+62	185	228
2	5 Apr 20 h 11 m	600	-22	-40	272	279
3	8 Apr 4 h 45 m	700	-47	-63	253	273
4	9 Apr 1 h 37 m	600	-53	-64	252	272
5	18 Apr 12 h 45 m	600	±30	+52	291	305
6	21 Apr 13 h 56 m	1000	-58	-45	208	220

Fig. 1 (curve 1) shows one of the primary γ-ray spectra (spectrum No. 3 in Table 1), taken above the dark side of the Moon. The background due to

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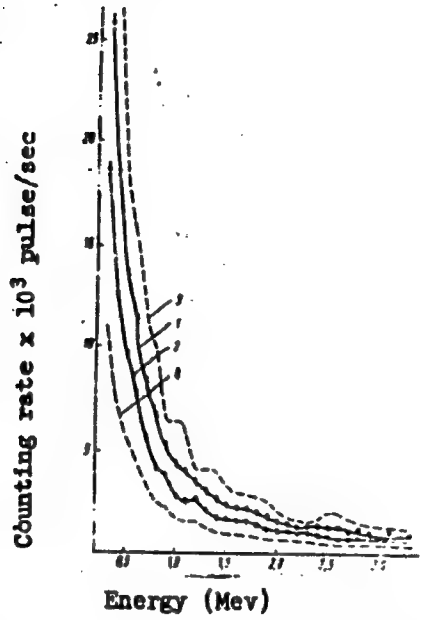

Fig. 1. Gamma-ray spectra obtained by Luna 10 while in orbit around the Moon and along the trajectory of the flight from the earth to the Moon

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1 - γ-ray spectrum of the lunar rocks together with the background; 2 - γ-ray spectrum of the background due to interaction of cosmic rays with the material of Luna 10 corrected for the screening by the Moon; 3 and 4 - same spectra as those given by 1 and 2, respectively, recalculated to represent measurements which would be taken at the surface of the Moon. The errors shown are root-mean-square errors.

interaction of cosmic rays with the substance of Luna 10, taking the screening by the moon into account, is also shown in Fig. 1 (curve 2).

Compared to the counting rate of γ-rays measured along the flight trajectory, the counting rate in orbit around the Moon increased by 30—40%.

As a result of the screening effect of the Moon, the background due to irradiation of the spaceship by cosmic particles near the Moon decreases and is equal to about 78—89% of the background encountered along the trajectory of the flight. The background spectrum was measured during the flight

of Luna 10 toward the Moon at a distance of about 230,000 km from the Earth. The principal part of the γ-ray background registered is associated with inelastic interactions of charged particles with the substance of Luna 10 and is not primary cosmic γ-radiation. The natural radioactivity was small due to the small amounts of K, Th, and U present in the spaceship. There were no radioactive sources aboard the Luna 10. Fig. 1 also shows curves calculated so as to represent measurements that would be obtained directly at the surface of the Moon. Curve 3 in Fig. 1 shows the γ-ray spectrum at the lunar surface together with the background due to irradiation of the spaceship, while curve 4 in Fig. 1 shows the background alone.

Fig. 2 (curve 1) shows the spectrum of γ-radiation of lunar rocks (after subtraction of the background) obtained by Lunar 10 while in orbit. This curve represents the difference between spectra represented by curves 1 and 2 of Fig. 1. Fig. 2 shows that the lunar γ-ray spectrum differs considerably from the spectrum of γ-radiation emitted by the surface of the Earth [not shown], the shape of which is primarily determined by the content of natural radioactive elements in the rocks. A distinguishing feature of the lunar γ-ray spectrum is its relatively flat slope and large number of

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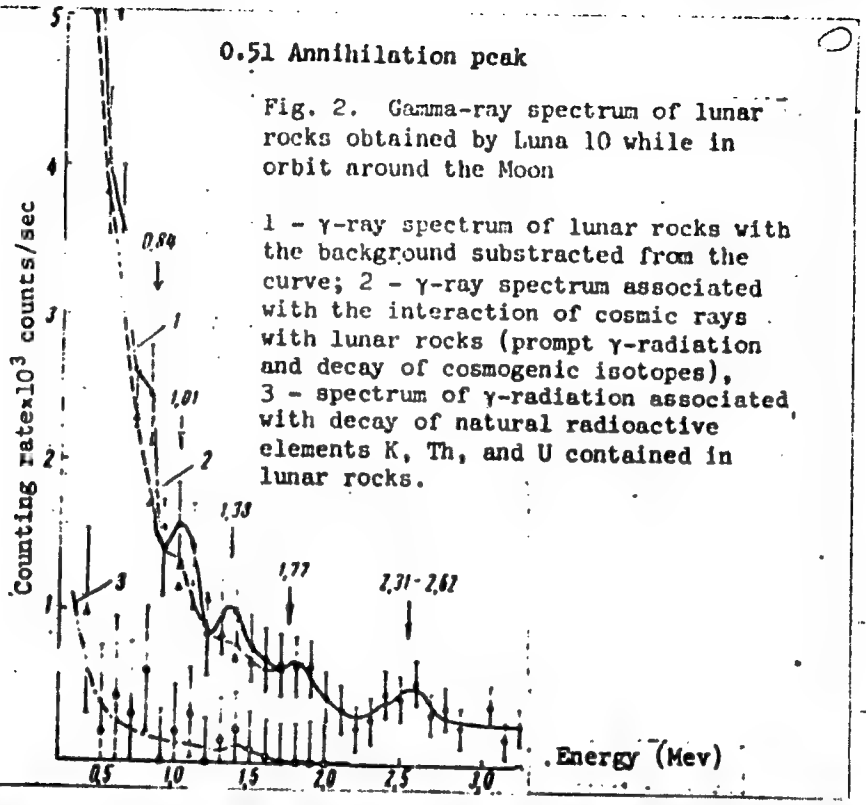

Fig. 2. Gamma-ray spectrum of lunar rocks obtained by Luna 10 while in orbit around the Moon

1 - γ-ray spectrum of lunar rocks with the background substracted from the curve; 2 - γ-ray spectrum associated with the interaction of cosmic rays with lunar rocks (prompt γ-radiation and decay of cosmogenic isotopes), 3 - spectrum of γ-radiation associated with decay of natural radioactive elements K, Th, and U contained in lunar rocks.

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hard γ-rays with energies in excess of 1.5 Mev while the spectrum of natural radioactive elements is characterized by a steep slope at higher energies and the absence of γ-rays with energies greater than 2.62 Mev. This shows that most γ-radiation from the lunar surface is not associated with the natural radioactivity of U, Th, and K^{40} but is the result of the interaction of cosmic rays with the lunar substance and the decay of cosmogenic isotopes.

Table 2 shows the characteristic γ-rays identified from the lunar γ-ray spectra and the principal nuclear reactions involving the probable constituent elements of lunar rocks. It can be seen from Table 2 that O, Si, Al, and Mg are likely the most widely distributed elements in lunar rocks.

Table 2. Energies of Gamma Rays Identified From the Lunar Gamma-Ray Spectra

Energy (Mev)	Principal Nuclear Reactions Causing Emission of Characteristic Gamma-Rays
0.84	$Al^{27}(p,p'\gamma)Al^{27}$, $Si^{28}(p,2p\gamma)Al^{27}$, $Fe^{56}(p,p'\gamma)Fe^{56}$
1.01	$Al^{27}(p,p\alpha\gamma)Al^{26}$, $Si^{28}(p,2p\alpha\gamma)Al^{26}$
1.37	$Mg^{24}(p,p'\gamma)Mg^{24}$, $Al^{27}(p,p\alpha\gamma)Mg^{23}$, $Si^{28}(p,p\alpha\gamma)Mg^{24}$
1.78	$Mg^{24}(p,p\alpha\gamma)Ne^{20}$, $Al^{27}p,2p\gamma)Mg^{26}$, $Si^{28}(p,p'\gamma)Si^{28}$
2.31 } 2.62 }	$O^{16}(p,2p\alpha\gamma)N^{14}$, $Mg^{24}(p,p\alpha\gamma)Mg^{23}$, $Mg^{24}(p,2p\gamma)Na^{23}$, $Al^{27}(p,p\ln\gamma)Mg^{23}$

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Since the lunar surface is exposed to constant interaction with cosmic rays, all of the cosmogenic radioisotopes should be in radioactive equilibrium. Therefore, both long-lived and short-lived radioisotopes should be radioactive, and their content should be proportional to the effective cross section for their production. Calculations show that the main contribution to γ-ray emission is made by the decay of the following cosmogenic isotopes: O^{14} ($T_{1/2}$ = 72 sec, E_γ = 2.31 Mev), O^{19} ($T_{1/2}$ = 27 sec, E_γ = 1.37 Mev), F^{20} ($T_{1/2}$ = 10.7 sec, E_γ = 1.63 Mev), Na^{22} ($T_{1/2}$ = 2.6 hr, E_γ = 1.28 Mev), Na^{24} ($T_{1/2}$ = 15 hr, E_γ = 1.37 Mev and 2.76 Mev). These radioisotopes are formed with a considerable yield in nuclear reactions involving the same rock-forming elements: Mg, Al, and Si.

The peak at 0.51 Mev, which is especially pronounced in the lunar γ-ray spectra measured in the energy range 0.15—1.5 Mev, is produced by γ-radiation emitted during annihilation.

Analysis of the results shows that the γ-radiation intensity corrected for the difference in height is practically constant above the different regions of the lunar surface (intensities did not differ by more than 40%). This can probably be attributed to the fact that the main source of γ-rays is cosmic radiation. A preliminary analysis shows that the total dose rate of

γ-radiation above the lunar surface is somewhat higher than the dose rate above the rocks of the Earth's crust. The dose rate of γ-radiation emitted by the lunar surface is roughly 1.5—2 times greater than that emitted by terrestrial granites (14 μr/h).

An evaluation of the natural radioactivity and the concentration of natural radioactive elements can be made by substracting the effect of γ-radiation produced in the ineraction of cosmic rays with lunar rocks from the overall lunar γ-ray spectrum. Although the exact shape of the γ-ray spectrum induced by cosmic rays is unknown, approximate results can be obtained by using the shape of the spectrum obtained along the flight trajectory of Luna 10 from the Earth to the Moon. Curve 2 in Fig. 2 shows the spectrum of γ-radiation from the Moon produced by cosmic rays, determined by combining the γ-ray spectra obtained along the flight trajectory with the γ-ray spectrum of the lunar rocks in the energy range exceeding 2 Mev (the contribution of the natural isotopes is almost zero). This approximation is justified only if the γ-ray spectra induced by cosmic rays in the spaceship and in the lunar rocks have the same shape and differ only in intensity. This assumption was demonstrated to be justified by both theoretical calculations and modeling experiments performed by the authors. The validity of this

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assumption follows from the fact that the spaceship and its components were made of light alloys of Si, Al, and Mg with very little Fe, i. e., the dominant elements in the composition of rocks. Curve 3 in Fig. 2, obtained by subtracting curve 2 from curve 1, shows the γ-ray spectrum produced by the decay of natural radioactive elements. Fig. 2 shows that 90% of the intensity of gamma radiation emitted by lunar rocks is produced by radioactivity induced by cosmic rays and no more than 10% by decay of K, Th, and U.

Prior to the flight the γ-spectrometer aboard the spaceship was precalibrated using samples with a measured amount of K, Th, and U and also with rock samples containing different amounts of these elements. This procedure made it possible to calculate the γ-ray spectra, which should be obtained by the orbiting spaceship, emitted by rocks with different amounts of natural radioactive elements (it was assumed that the radiation produced by cosmic rays is absent). Fig. 3 shows such spectra which would be obtained at a height of 350 km with the background subtracted from the spectrum. The hatched areas correspond to range of concentrations of radioactive elements for given types of rock. The average values of concentrations of K, Th, and U were taken from a paper by A. P. Vinogradov (Geokhimiya, no. 7, 1962).

Comparison of the lunar γ-ray spectra with those of terrestrial rocks with a known content of K, Th, and U shows that at least in the regions of the Moon over which measurements were conducted there are no rocks on the lunar surface, or at a depth not exceeding 27 cm, containing the same amount of K, Th, and U as do the acidic terrestrial rocks, such as granites. The intensity of γ-radiation due to natural radioactivity (Fig. 2, curve 3) tends to indicate the presence of basic rocks such as basalts. However, at the present time it is impossible to exclude the possibility that the concentration of natural radioactive elements was estimated a bit too high. It is interesting to note that tektites, which have almost the same composition and amounts of U, Th, and K as acidic rocks, cannot be of lunar origin.

Conclusions

The main results obtained from the measurements of the intensity and spectral composition of γ-radiation by the Luna 10 can be summarized as follows:

1. The overall level of γ-radiation of the lunar surface slightly exceeds that of the Earth. Preliminary results show that the intensity of γ-radiation of

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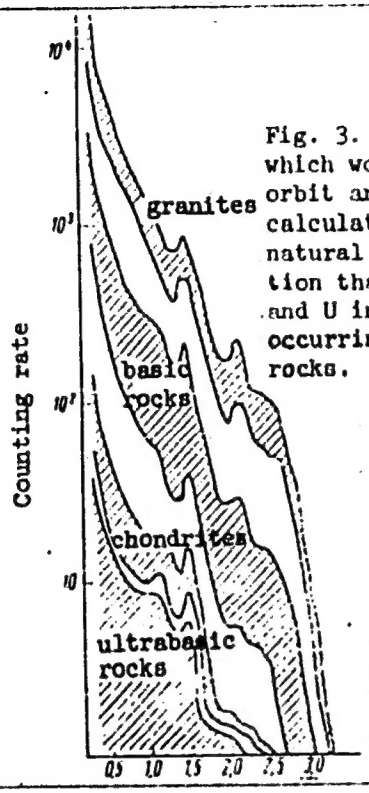

Fig. 3. The γ-ray spectra of lunar rocks which would be observed by a spaceship in orbit around the Moon. The spectrum was calculated from the γ-ray spectra of natural radioactive elements on the assumption that the relative contents of K, Th, and U in lunar rocks correspond to those occurring in the most important terrestrial rocks.

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